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Primary anastomosis with or without T-tube enterostomy in jejuno-ileal atresia-a comparative study

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ABSTRACT

Aims: Various surgical procedures are in practice for the management of jejuno-ileal atresia. Most used technique is resection of dilated segment of gut and primary anastomosis. But mortality and morbidity still remains high. Primary anastomosis with T- tube enterostomy is a recent concept for the treatment of jejuno-ileal atresia. It seems to offer important advantages over other surgical techniques. The aim of this study was to evaluate the effectiveness of T-tube enterostomy to reduce morbidity and mortality of neonate suffering from jejuno-ileal atresia.

Methods: It was a prospective comparative interventional study which was conducted in Bangladesh Shishu (Children) Hospital from March 2017 to September 2019. A total of 54 patients with uncomplicated jejuno-ileal atresia were selected for this study after fulfillment of inclusion and exclusion criteria. They were randomly assigned to primary anastomosis with T-tube enterostomy group (group A=26) and primary anastomosis without T-tube enterostomy group (group B=28). The comparative parameters between two groups were start of post-operative bowel movement, establishment of complete oral feeding, duration of hospital stay, anastomotic leakage and mortality. All patients were followed up for 6 months post operatively.

Results: The age range of the patients was 2 to 10 days where majority of the patients were male. Most of the patients were male in both groups. After operation, mean time to start bowel movement of group A 4.68±1.21 days and group B 5.29±1.82 days and there was no significant statistical difference. Time to establish complete oral feeding of group A (9.04±1.43 days) and group B (10.38±2.18 days) showed significant difference (p=xv 0.016). Rate of anastomotic leakage in group A was 7.7% and group B was 32.1% which was statistically significant (p=0.041). Rate of mortality was higher in group B (32.1%) compared to group A (7.7%) which was statistically significant (p=0.026). Time of post- operative hospital stay in group A (14.19±2.22 days) and group B (16.39±3.97 days) showed significant difference (p=0.015).

Conclusion: Primary anastomosis with T-tube enterostomy was found as an effective procedure to reduce morbidity and mortality of patients with jejuno-ileal atresia.

Keywords: T-tube enterostomy, jejuno-ileal atresia, intestinal obstruction

INTRODUCTION

Management of jejuno-ileal atresia remains a major challenge for neonatal and paediatric surgeons worldwide, requiring rapid resuscitation and timely surgical intervention. Despite advances in neonatal care, morbidity and mortality rates remain high, particularly in developing countries.[1,2] Intestinal atresia refers to congenital complete obstruction of the intestinal lumen, most commonly affecting the duodenum, jejunum, or ileum, and rarely the colon.[3] Jejuno-ileal atresia is one of the leading causes of neonatal intestinal obstruction.[4] The marked discrepancy between the dilated proximal and narrow distal segments contributes to significant anastomotic complications,[5] making this condition a frequent indication for intestinal resection with associated high morbidity and mortality (**Figure 1**).[6] Over recent decades, improvements in neonatal intensive care, operative techniques, and the use of total parenteral nutrition (TPN) have reduced mortality in developed settings.[1,7] However, in resource-limited countries, outcomes remain poor.[8] Current treatment options include resection with primary anastomosis or exteriorization with delayed anastomosis.[9]

The key principle is bowel preservation, management of the dilated proximal segment, and early initiation of oral feeding.[6] The most widely used approach—resection and end-to-back anastomosis—often requires removal of the dilated proximal segment, risking short bowel syndrome. Moreover, disparities in diameter and peristalsis between proximal and distal segments predispose to anastomotic leakage, sepsis, and bacterial overgrowth.[7,10] Short bowel syndrome remains a major postoperative concern.[11] To minimize bowel loss, techniques such as tapering enteroplasty, antimesenteric plication, and the Bianchi procedure have been described, though each carries risks of electrolyte imbalance and metabolic complications.[4,12] Alternatively, stoma-forming procedures such as the Mikulicz, Bishop-Koop, and Santuli methods allow decompression of the dilated bowel and reduce anastomotic leak rates.[11] Yet these techniques entail high-output stomas, fluid-electrolyte disturbances, malnutrition, and morbidity from subsequent stoma closure.[13,14] Use of transanastomotic tubes in duodenal atresia has shown favorable outcomes, facilitating early recovery.[15,16] The intraluminal T-tube, first used in hepatobiliary surgery by Hans Kehr, functions as a stent providing both internal and external drainage.[17,18] Its application in uncomplicated meconium ileus has proven safe and effective.[19,20] Chaet et al.[21] first reported T-tube use in jejuno-ileal atresia. Primary anastomosis with transanastomotic T-tube enterostomy offers dual benefits: internal drainage and decompression, functioning as a low-output stoma without the need for secondary surgery. The tube can be easily removed, and the site heals spontaneously.[22] Furthermore, preserving the dilated proximal segment prevents short bowel syndrome.[11] Previous studies demonstrated improved outcomes with this approach.[6,11] Given these promising findings and successful T-tube use in meconium ileus in Bangladesh, this study was undertaken to evaluate the role and effectiveness of primary anastomosis with T-tube enterostomy in the management of jejuno-ileal atresia.

Figure 1. Per operative picture of jejuno-ileal atresia (type-IIIB)

METHODS

Ethics

Ethical clearance was obtained from the Ethical Review Committee of Bangladesh Institute of Child Health & Bangladesh Shishu Hospital (Date: 21.05.2018, Decision No: BICH-ERC-12/01/2018). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki. Written informed consent was obtained from guardians.

Study Design

This was a prospective comparative interventional study.

Study Place

This was a prospective comparative interventional study. The study was conducted in the Division of Paediatric Surgery, Bangladesh Institute of Child Health & Bangladesh Shishu (Children) Hospital, Dhaka.

Study Duration

The study period was two years and six months, from 1st March 2017 to 30th September 2019.

Study Population

Patients diagnosed with jejuno-ileal atresia at Bangladesh Shishu Hospital during the study period were included.

Sampling Technique

Randomized sampling was applied. Patients preliminarily diagnosed with jejuno-ileal atresia were enrolled after obtaining informed consent from guardians, with final diagnosis confirmed during surgery.

Selection Criteria

- **Inclusion:** All neonates with uncomplicated jejuno-ileal atresia confirmed during surgery.
- **Exclusion:** Major congenital anomalies affecting outcome and multiple atresia.

Sample Size

Calculated using the formula:
$n=(P1(1-P1)+P2(1-P2))/((P1-P2)^2)\times(Z\alpha+Z\beta)^2$, with P1=0.44, P2=0.14, Zα=1.96, Zβ=0.85. The required sample was 32 per group, totaling 64 patients.

Randomization

Sixty-four cards (32 per group) were used. Guardians picked cards to allocate patients to group-A (primary anastomosis with T-tube enterostomy) or group-B (primary anastomosis without T-tube enterostomy).

Data Collection

Information was recorded using a pre-designed semi-structured questionnaire. Variables included time to bowel movement, time to complete oral feeding, postoperative morbidity and mortality, and duration of hospital stay.

Preoperative Evaluation and Treatment

Patients were assessed for general condition, associated anomalies, and intestinal obstruction. Investigations included CBC, electrolytes, bilirubin, chest X-ray, and echocardiogram as indicated. Preoperative care included NPO, nasogastric decompression, intravenous fluids, antibiotics, and vitamin K.

Operative Procedures

- **Group-A:** Minimal bowel resection, end-to-back anastomosis with 12 Fr T-tube for decompression and stenting (**Figure 2-4**).

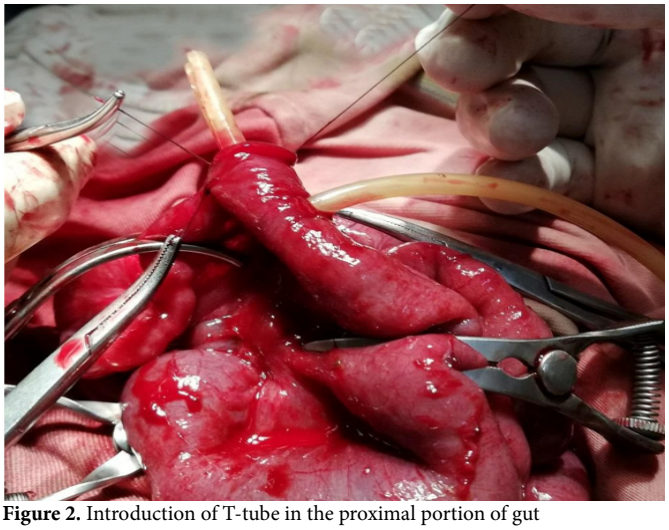

Figure 2. Introduction of T-tube in the proximal portion of gut

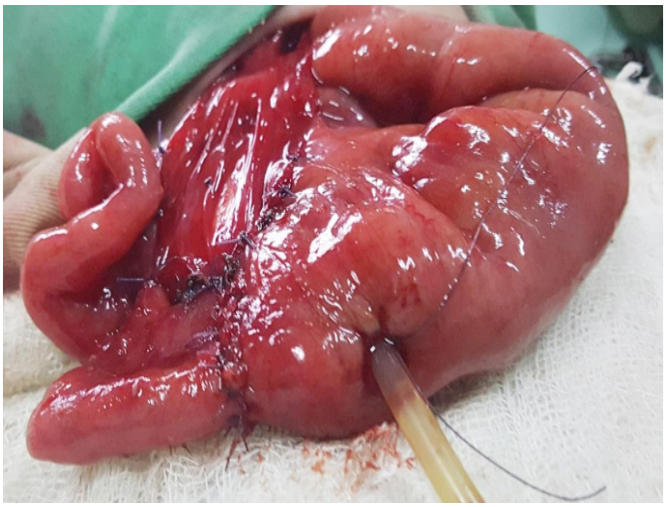

Figure 3. Primary anastomosis with placement T-tube proximal to anastomotic site

Figure 4. Primary anastomosis with T-tube enterostomy

- **Group-B:** Resection of dilated proximal bowel followed by end-to-back anastomosis (**Figure 5**).

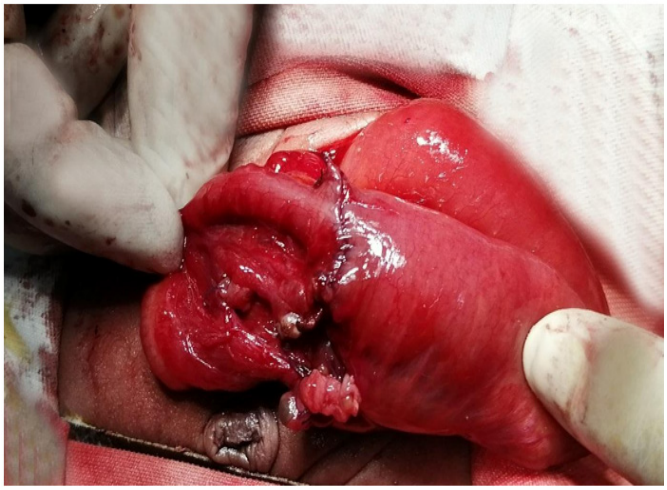

Figure 5. Primary anastomosis without T-tube enterostomy

Postoperative Care and Follow-up

Patients received NPO, nasogastric suction, IV fluids, antibiotics, and analgesics. Oral feeding was started after bowel movement. Group-A T-tube output was monitored and removed after clinical readiness (**Figure 6**). Patients were followed for vital signs, abdominal condition, wound status, and complications.

Figure 6. Spontaneous closure of wound after removal of T-tube

Diagnosis and Management of Complications

Anastomotic leakage, bowel obstruction, sepsis, wound infection, and wound dehiscence were identified based on clinical and radiological findings and managed appropriately.

Discharge and Follow-up

Patients were discharged after tolerance of complete oral feeding and wound healing, with advice on signs of complications. Follow-up visits were scheduled at 2nd, 4th week, 3rd and 6th month postoperatively.

Statistical Analysis

Data were analyzed using SPSS v25. Continuous variables were assessed with Student's t-test, categorical variables with Chi-square or Fisher's exact test. $p<0.05$ was considered significant.

RESULTS

A total of 64 patients meeting inclusion and exclusion criteria were enrolled and randomly allocated into two groups: group A (n=32) and group B (n=32). Twenty-six patients in group A and 28 patients in group B completed the six-month follow-up. The results of these 54 patients are presented below.

Demographic and Baseline Characteristics

The mean age at presentation in group A was 4.04±1.75 days and in group B was 4.14±1.88 days, with no significant difference between groups (p=0.834, Student's t test, **Table 1**). Gender distribution was similar, with 15 (57.7%) males in group A and 17 (60.7%) males in group B (p=1.000, Chi-square test, **Table 2**). Type IIIA atresia was most common in both groups (42.3% in group A, 39.3% in group B), with no significant difference in type distribution (p=0.973, Fisher's exact test, **Table 3**).

Table 1. Age at operation

Age (days)	Group A (n=26)	Group B (n=28)	p value
2-3	12 (46.2%)	11 (39.3%)	
4-5	10 (38.5%)	11 (39.3%)	
>6	4 (15.4%)	6 (21.4%)	
Mean±SD	4.04±1.75	4.14±1.88	0.834
Range	2-10	2-9	

SD: Standard deviation

Table 2. Gender distribution

Gender	Group A no. (%)	Group B no. (%)	p value
Male	15 (57.7%)	17 (60.7%)	1.000
Female	11 (42.3%)	11 (39.3%)	

Table 3. Type of atresia

Type	Group A no. (%)	Group B no. (%)	p value
Type I	4 (15.4%)	4 (14.3%)	0.973
Type II	9 (34.6%)	11 (39.3%)	
Type IIIA	11 (42.3%)	11 (39.3%)	
Type IIIB	2 (7.7%)	2 (7.1%)	

Post-Operative Outcomes

The mean time for establishment of bowel movement postoperatively was 4.68±1.21 days in group A and 5.29±1.82 days in group B (p=0.166, Student's t test. Group A patients initiated oral feeding earlier than group B (6.96±1.39 vs. 8.29±2.18 days), with this difference being statistically significant (p=0.015. Similarly, the mean time to achieve complete oral feeding was shorter in group A (9.04±1.43 days) compared to group B (10.38±2.18 days), which was significant (p=0.016, **Table 4**). In group A, the mean time of T-tube removal was 10.67±1.52 days (range 8-13 days, **Table 4**).

Complications

Anastomotic leakage occurred in 2 patients (7.7%) in group A and 9 patients (32.1%) in group B, showing a significant difference (p=0.041, Chi-square test, **Table 5**). Postoperative obstruction occurred in 2 patients (7.1%) in group B, while none occurred in group A (p=0.491. Wound infection was observed in 1 patient (3.8%) in group A and 3 patients (10.7%) in group B (p=0.612, **Table 6**). Wound dehiscence occurred in 1 patient in group A and 2 patients in group B (p=0.528, **Table 6**).

Table 4. Post-operative outcomes

Parameter	Group A (n=26)	Group B (n=28)	p value
Time to bowel movement (days)	4.68±1.21	5.29±1.82	0.166
Time to start oral feeding (days)	6.96±1.39	8.29±2.18	0.015
Time to complete oral feeding (days)	9.04±1.43	10.38±2.18	0.016
T-tube removal (days)	10.67±1.52	-	-
Post-op hospital stay (days)	14.19±2.22	16.39±3.97	0.015

Table 5. Anastomotic leakage

Anastomotic leakage	Group A no. (%)	Group B no. (%)	p value
Absent	24 (92.3%)	19 (67.9%)	0.041
Present	2 (7.7%)	9 (32.1%)	

Table 6. Other complications

Complication	Group A no. (%)	Group B no. (%)	p value
Post-op obstruction	0 (0%)	2 (7.1%)	0.491
Wound infection	1 (3.8%)	3 (10.7%)	0.612
Wound dehiscence	1 (3.8%)	2 (7.1%)	0.528
Mortality	2 (7.7%)	9 (32.1%)	0.026

Mortality and Hospital Stay

Mortality was significantly lower in group A (2 patients, 7.7%) compared to group B (9 patients, 32.1%; p=0.026, Chi-square test. The mean postoperative hospital stay was also significantly shorter in group A (14.19±2.22 days) than in group B (16.39±3.97 days; p=0.015, (**Table 6**).

DISCUSSION

Management of jejuno-ileal atresia remains a surgical challenge. Various techniques such as resection with end-to-back anastomosis, tapering enteroplasty, Mikulicz, Bishop-Koop, Santulli, and T-tube enterostomy are employed. This study compared outcomes of primary anastomosis with or without T-tube enterostomy. About 38% of patients were operated within 4-5 days of age, while 18.5% presented after 6 days, often due to referrals from other hospitals. The mean age was approximately 4 days in both groups, consistent with Shahjahan et al.[23] and Rouzrokh et al.[11] Most neonates were male, similar to findings of Shakya et al[10] and Shahjahan et al,[23] although jejuno-ileal atresia is typically gender-neutral.[24] Type III A atresia was the most common, with no significant difference between groups. Postoperative bowel movement occurred earlier in the T-tube group (4.68±1.21 days) than without T-tube (5.29±1.82 days), though this difference was not statistically significant. Early bowel movement facilitated earlier initiation of oral feeding. Primary anastomosis with

T-tube enterostomy allowed proximal gut decompression and gradual flow to the distal bowel, stimulating peristalsis. Consequently, first and complete oral feeding started earlier in the T-tube group, consistent with Rouzrokh et al,[11] though absolute times were shorter in this study due to lack of TPN facilities. T-tube removal occurred on average at 10.67 days without complications, similar to Al-Zaiem et al.[25] Anastomotic leakage was significantly higher in the primary anastomosis without T-tube group, likely due to increased intraluminal pressure. Rates of postoperative obstruction were also higher without T-tube, though not statistically significant, consistent with Ali and Saleem[26] and Shakya et al.[10] Dilated proximal bowel and disturbed intestinal transit contribute to such complications.[27,28] Wound infection and dehiscence were lower with T-tube enterostomy (3.8% each) compared to without T-tube (10.7% and 7.1%), though not statistically significant. Secondary closure was required in cases of dehiscence. Stasis and bacterial overgrowth in the non-T-tube group likely contributed to higher wound complications. Mortality was 20.3% overall, with higher rates in the non-T-tube group, consistent with Rouzrokh et al.[11] Delayed presentation, systemic sepsis, metabolic disturbances, and absence of antenatal diagnosis contributed to mortality. Limited NICU availability and lack of TPN support at Dhaka Shishu Hospital may have influenced outcomes. Anastomotic leakage, atonic proximal bowel, and bacterial overgrowth are key factors in postoperative sepsis.[29] Postoperative hospital stay was significantly shorter in the T-tube group due to early feeding and fewer complications, aligning with Rouzrokh et al.[11] Overall, T-tube enterostomy was associated with reduced complications, earlier feeding, and shorter hospitalization compared to primary anastomosis alone.

Recommendations

- Primary anastomosis with T-tube enterostomy should be the preferred surgical option in the management of jejuno-ileal atresia.
- Multi-center based, larger prospective studies are needed to validate our findings.

Limitations

- Surgical procedure was performed by different surgeons which can affect the outcome.
- Because of lack of logistic support, financial constraints and lack of availability of coagulation profile, S. bilirubin, chest X-ray, Ultra sonogram of whole abdomen and Contrast X-ray could not be done in all patients. Result could have been influenced due to lack of these facilities.
- Unavailability of surgical ICU and TPN facility could also have influenced the outcome.

CONCLUSION

This study concludes that, use of T-tube enterostomy proximal to primary anastomosis is helpful to the healing of the anastomotic site in jejuno-ileal atresia. This procedure can improve the outcome and overcome the difficulties regarding the management of jejuno- ileal atresia.

ETHICAL DECLARATIONS

Ethics Committee Approval

Ethical clearance was obtained from the Ethical Review Committee of Bangladesh Institute of Child Health & Bangladesh Shishu Hospital (Date: 21.05.2018, Decision No: BICH-ERC-12/01/2018).

Informed Consent

Informed consent was obtained from a parent or legal guardian. Where appropriate, age-adjusted assent was also obtained from the child. The inclusion of vulnerable populations in this study adhered to national and international ethical guidelines. Extra care was taken to ensure voluntary participation, understanding, and protection of participant dignity and autonomy.

Peer Review Process

This manuscript was subject to external peer review.

Conflict of Interest

The authors declare no conflicts of interest related to this study.

Financial Disclosure

The authors received no financial support for the conduct or publication of this research.

Author Contributions

Concept: AAF; Design: AAF, TT; Control: AAF, AR; Resources: AAF, TT, AR; Materials: AAF, TT; Data Collection and/or Processing: AAF, TT; Analysis and/or Interpretation: AAF, TT; Literature Review: AAF, TT; Writing the Article: AAF, TT; Critical Review: AR.

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